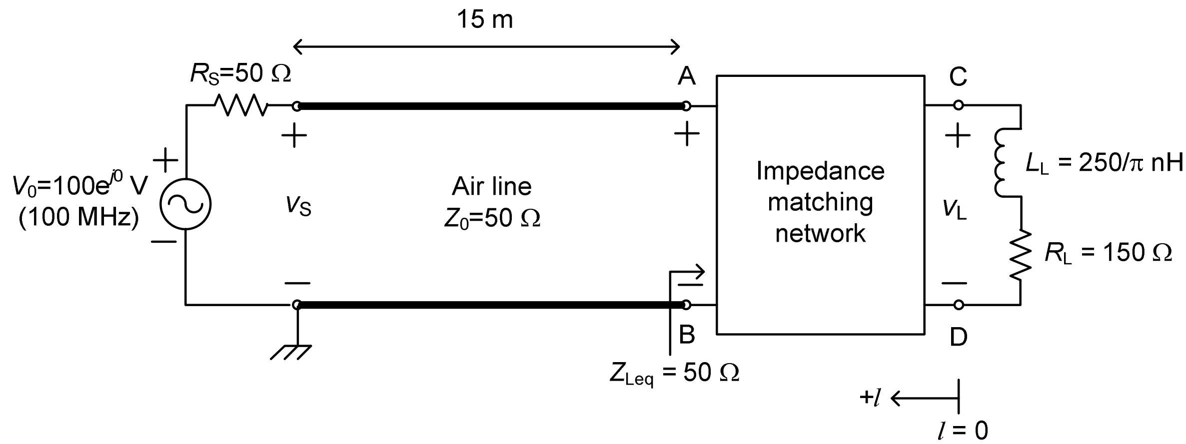
University ☺f P☺rtland
Sch☺☺l ☺f Engineering

EE 301
Spring 2014
A.Inan

<u>Homework # 7</u>
<u>Designing Impedance Matching Networks</u>
(Assigned: Monday, April 7, 2014)
(<u>Due: Monday, April 14, 2014, 11:25a.m.</u>)

A 50 Ω, 15 m long air transmission line is used to deliver power from a 100-V amplitude, 100-MHz frequency sinusoidal voltage source to an inductive load connected between terminals C-D, as shown.



(1) Calculate the load reflection coefficient Γ_L and the standing wave ratio S for the case when the inductive load is connected directly to the line (that is, there is no impedance matching network).
(2) For part (1), find the time-average power delivered to the load and the percentage of the incident wave power that reflects back towards the source.
(3) Design a single, series, lumped, reactive element impedance matching network to match Z_L to Z_0. Introduce the series lumped element as close as possible to the load and determine its type and value. Draw the complete circuit with the matching network included. Indicate the impedance matching network in a box and provide all the pertinent values on the circuit such as the position and the value of the reactive element.
(4) Repeat part (2) for the circuit of part (3).
(5) Redesign part (3) by replacing the single, series, reactive element with a short-circuited 50 Ω stub. Again, position the stub as close as possible to the load. Redraw the complete circuit by enclosing the matching network in a box and providing all the pertinent values.
(6) Repeat part (3) for the case of a single, <u>shunt</u>, lumped, reactive element.
(7) Repeat part (2) for the circuit of part (6).
(8) Redesign part (6) by replacing the single, reactive, shunt element with a short-circuited 50 Ω stub. Again, position the stub as close as possible to the load.

Redraw the complete circuit by enclosing the matching network in a box and providing all the pertinent values.

(9) Design a quarter-wave transformer to match Z_L to Z_0. Introduce the quarter-wave transformer as close as possible to the load. Determine the characteristic impedance Z_{QT} of the transformer, its length l_T, and its position l_1 with respect to the load. Draw the complete circuit with the quarter-wave transformer matching network included. Enclose the impedance matching network in a box and provide all the pertinent values on this circuit such as the values of Z_{QT}, l_T, and l_1.

(10) Repeat part (2) for the circuit of part (9).

<u>An Important Reminder Note:</u>

<u>EE 301-Final Exam is scheduled to be given on Thursday, May 1, 2014, 10:30-12:30!</u> ☺

(It will be in-class closed-book exam. Three formula sheets will be allowed.)

See the next page for the Results Summary Table!

Full Name: ______________________ Date:

EE 301-Spring 2014-Homework # 7-Results Summary Table

Table 1. Summary of the calculation results for Problems 1 to 10

Problem Number	Result*	Result*
1	Γ_L =	S =
2	P_L =	% P^-/P^+ =
3**	l_1 =	L_S = C_S =
4	P_L =	% P^-/P^+ =
5	l_1 =	l_{stub} =
6**	l_1 =	L_P = C_P =
7	P_L =	% P^-/P^+ =
8	l_1 =	l_{stub} =
9	l_1 =	Z_{QT} =
10	P_L =	% P^-/P^+ =

* Whenever needed, please provide the appropriate unit for each result, or else, you won't get any credit for the numerical result you provide!

**In the second result column for Problems 3 and 6, you will provide the value of either the inductor or the capacitor of the impedance matching network, not both.